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ABSTRACT

In a previous study, the benefits of matching instruction with students' needs were examined. Three personality variables were used for the purpose of matching: Maslowian need level; locus of control; and cognitive style. This study used the ninth-grade physical science students (N=301) participating in the previous study to (1) examine differences in the cognitive and affective entry characteristics of students expressing different Maslowian needs and (2) to determine the effects of teaching a 3-week unit of instruction using a strategy designed to meet the locus of control and cognitive style needs of students whose physiological and safety needs had not been accommodated. Results show: significant differences in the cognitive and affective entry characteristics of students of differing need levels; students differed in their attitudes toward science in general and their prior knowledge of physical science; and matching was not beneficial for students primarily concerned with fullfillment of low needs. In addition, differences in achievement (not attitude) were found to be dependent upon the extent of matching. These and other results are discussed in terms of the matching model of instruction and the desire to design instruction to accommodate the diversity of student needs in secondary school physical science courses. (Author/JN)

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Attitude and Achievement in Ninth Grade Physical Science of Low Need Level Students: A Reexamination of the Matching Hypothesis

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Attitude and Achievement in Ninth Grade Physical Science of
Low Need Level Students: A Reexamination of the Matching Hypothesis

The matching hypothesis was the focus of an investigation conducted with students enrolled in ninth grade physical science classes in a small urban school district in central Texas. The results of the study, reported at the 1983 NARST meeting held in Dallas, Texas, indicated that designing instruction to meet psychological, locus of control, and cognitive style needs produced limited benefits. Unexpected, however, was the finding in the experimental school that more than half of the 301 physical science students who constituted the sample expressed primary psychological needs classified as maintenance. For these students basic physiological and safety needs had not been satisfied. Possessing characteristics that were inconsistent with the underlying assumptions, these students were dropped from the study, leaving only those students who expressed primary needs for love and belonging, esteem, and higher.

Purpose

This study involved an examination of the cognitive and affective entry characteristics of ninth grade physical science students and the benefits of matching. More specifically, the study sought to address two basic questions that emerged from a previous investigation of "The Effects of Matching Instructional Strategy With Selected Student Characteristics on Ninth Grade Physical Science Students' Attitudes and Achievement" (Trout and Crawley, in press). The two questions addressed in this study were:

1. Are their differences in the cognitive and affective entry characteristics of physical science students who express different Maslowian needs?
2. What are the effects of teaching a three week unit of instruction using a strategy designed to meet the locus of control and cognitive style needs of students whose physiological and safety needs have not been accomodated?

Theoretical Basis

The study explored the benefits of matching instruction with the needs of students enrolled in ninth grade physical science using a social learning theory paradigm (Rotter, Chance, and Phares, 1972 and Rotter, 1980). According to social learning theory, a behavior is made more probable by increasing both the expectancy that the behavior will result in reinforcement and

the value of the anticipated reinforcement, within the context of the situation in which the desired behavior is to occur. Generalized expectancies regarding potential reinforcements is a construct postulated by Rotter in terms of the variable locus of control. Persons who feel entirely responsible for the reinforcements they receive are said to have an internal locus of control; those persons who feel their reinforcements are under the control of others or occur by chance are said to have an external locus of control. Value is derived from the role of the expected reinforcement in need gratification. Individuals on a given need level, according to Maslow's(1976) need hierarchy, should value reinforcements which satisfy that particular need more than reinforcements which gratify other, less strongly felt needs. The context of a situation is psychological in nature, dependent upon a person's perception of a situation and the ability to distinguish behavioral cues from the surrounding, a construct that has come to be called field independence/dependence. Field independent persons can easily differentiate among selected elements of the perceptual field, while field dependent persons cannot.

Three theoretical constructs of social learning theory are thus considered as personality characteristics which can be measured for individual students. Furthermore, each of these characteristics has educational implications which allow for its accomodation through instructional practices. The assumed additive nature of these three characteristics allows for the formulation of an instructional model through which desired educational outcomes, attitudes and achievement, should be enhanced by matching students with instruction designed to complement their individual differences, in this study a particular combination of personality characteristics or associated learning needs.

Matching varied from complete(i.e., matching on all three variables) to incomplete(i.e., matching on none of the variables). Given the additive nature of the matching model under investigation, the more complete the match is between student needs and instructional characteristics the greater should be the enhancement of educational outcomes, namely attitude and achievement.

The design of this investigation was quasi-experimental with aspects of action-oriented research. Students remained in intact class groups, rendering true randomization impossible. While trained observers were used to ensure the construct validity of the instructional strategy, full control over the implementation of the strategy was lacking.

Procedures

A brief description is provided of the procedures followed in the initial study; additional details can be found in the study by Trout and Crawley(,n press). Two high schools were selected for the study. One high school was randomly selected to serve as the experimental school, the other served as the control school for purposes of testing the representativeness of students in the experimental school. Physical science teachers from both schools participated in training sessions. Teachers in the experimental school were trained to use an instructional strategy designed to complement the learning needs of students with a particular combination of personality characteristics--the need for love and belonging, an external locus of control, and a field dependent cognitive style. Teachers in the control group, on the other hand, were provided with training designed to improve their general presentational styles, without regard for the personalities of the students in their classes. Students in the two schools were taught a series of physical science topics chosen by the participating teachers from the district's curriculum guide.

Personality characteristics were determined using well established, commercially available instruments. Maslowian need level was assessed using the Need Satisfaction Scale - II, developed by Lollar and Smits(1979). The Nowicki-Strickland Locus of Control Scale for Children(Nowicki and Strickland,1973) was used to measure locus of control. Cognitive style was assessed using the Group Embedded Figures Test(Witkin, Oltman, Raskin, and Karp, 1971). Attitudes toward science class, science in general, science instruction, and the science teacher were measured using the semantic differential technique. Achievement was measured using a test designed specifically for the study. Reliability and validity information on all instruments has been reported(Trout and Crawley, in press).

The study commenced with a series of tests to assess students' personality characteristics, followed by attitude and achievement pretests. A treatment period of 21 class days then followed in experimental and control schools. The study concluded with a series of attitude and achievement posttests. Once the representativeness of students in the experimental school was established on cognitive and affective measures, the control school was no longer used. The design of the study provided natural control groups, according to levels of compatibility, within the experimental school for purposes of testing the benefits of matching.

Data were initially analyzed for students in the experimental school whose primary need was one of two levels, love and belonging or esteem. Of the 301 students in the experimental

school, 191 students were excluded from subsequent analyses, 25 due to incomplete data and 166 due to their low levels of Maslowian need. Thus all students for whom data were used in the original study(n=110) could be classified into one of eight possible cells formed by three independent variables of two levels each. The treatment consisted of instruction using cooperative grouping, task-independent rewards, and lessons in which social content and factual material were stressed. Results showed matching to be an effective means of improving attitude toward science but not achievement or attitude toward science class, science instruction, or the science teacher.

The present study examined the entry characteristics of the 301 students in the experimental school and the benefits of matching for the 166 students excluded from the initial study. Students who have unsatisfied physiological and safety needs constituted over half of the students in the original matching investigation. Differences in the cognitive and affective entry characteristics of all students, grouped according to primary need level, were tested using ANOVA procedures. Next, the effects of matching were tested for low need level students using ANCOVA procedures, with levels of compatibiltiy(0, 1, or 2) between instruction and students characteristics(i.e., cognitive style and locus of control) serving as the independent variable and adjusted posttest scores on attitude and achievement measures serving as the dependent variables.

Results

Significant differences were found in the cognitive and affective entry characteristics of students with different Maslowian needs. In particular, students differed in their attitudes toward science in general($p<.01$). Students primarily concerned with fulfilling growth needs(love and belonging, esteem, and higher) expressed a more positive attitude toward science in general than did their counterparts who were primarily concerned with maintenance needs(physiological and safety). Furthermore, students differed in their prior knowledge of the physical science topics($p<.05$). Students primarily concerned with the fulfillment of love and belonging needs registered lower levels of prior knowledge of the physical science topics taught during the investigation than did their peers who expressed primary concern with the fulfillment of physiological, safety, esteem, or higher level needs.

Matching did not prove to be beneficial for students primarily concerned with the fulfillment of physiological and safety needs. Using an instructional strategy designed to accomodate a field dependent cognitive style, an external locus of control, and a need for love and

belonging did not enhance attitudes on any of the outcomes addressed in the study, even though a majority of the students were found to be field dependent and external in their locus of control. Matching did produce achievement differences according to the level of compatibiltiy($p < .01$). Unfortunately, matching had a deleterious effect on students' achievement. Students who were completely incompatible with the treatment(i.e., field independent, internal locus of control) outperformed students who were completely compatible with the instructional strategy(i.e., field dependent, external locus of control).

Implications

The results of this study indicate that matching is indeed a complex process, and the variables which might prove useful for matching purposes are not at all obvious. Whether externally or self imposed, the desire of teachers of introductory physical science courses to design instruction in such a manner as to meet the varied personality-related learning needs of most, if not all students, is well intentioned perhaps but most likely produces limited results. Little, if any, support is provided in this study for such well-intentioned efforts.

Bibliography

Lollar, D. J. and Smits, S. J. (1979). Need satisfaction schedule - Manual for forms I and I. Atlanta, GA.: Atlanta Pediatric Psychology Associates.

Maslow, A. H. (1976). Motivation and personality. New York: Harper and Row.

Nowicki, S. and Strickland, B. R. (1973). A locus of control scale for children. Journal of Consulting and Clinical Psychology, 40(1), 148-154.

Rotter, J. B. (1980). Social learning and clinical psychology (3rd edition). Englewood Cliffs, N. J.: Prentice-Hall.

Rotter, J. B., Chance, J. E., and Phares, E. J. (Eds.) (1972). Applications of a social learning theory of personality. New York: Holt, Rinehart, and Winston.

Trout, J. S. and Crawley, F. E. (in press). The effects of matching instructional strategy with selected student characteristics on ninth grade physical science students' attitudes and achievement. Journal of Research in Science Teaching.

Witkin, H. A., Oltman, P. K., Raskin, E., and Karp, S. A. (1971). A manual for the embedded figures tests. Palo Alto, CA.: Consulting Psychologists Press.